A Study of Microbial Isolates from Blood at a University Teaching Hospital

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Background: Bloodstream infections referred to as septicemia/bacteremia is an important cause of morbidity and mortality. The knowledge of pattern of causative microbial agents in these infections is important for their prevention and empirical antimicrobial treatment while awaiting laboratory results.

Purpose: Our aim was to identify the spectrum of common bloodstream isolates at King Edward Medical University / Mayo Hospital, Lahore.

Study design: Descriptive, cross sectional, retrospective.

Study period: Three years, April 2006 to March 2009.

Methods: At the department of Pathology, King Edward Medical University/Mayo Hospital, standard Manual blood culture system for isolation of aerobic microorganisms is under practice. Analysis of aerobic microbial organisms isolated from blood culture samples was conducted.

Results: Staphylococcus aureus was the most common organism isolated, accounting for 56.43% of the total blood culture isolates, followed by Pseudomonas aeruginosa (13.21%), Acinetobacter spp. (11.79%) and Eschericia coli (9.64%). There was only one fungal isolate (Candida spp).

Conclusions: The present study revealed that staphylococcus aureus was the most common organism isolated from blood. We recommend further periodic studies be carried out to know whether the pattern and range of blood culture isolates remains the same or changing.

Key words: Aerobic, Analytical study, Bacteremia, Blood culture, Microorganism, Septicemia.

Introduction

Normal blood is sterile. Asymptomatic transient bacteraemia can occur during the course of many infections in the body. Septicemia refers to an invasive bacterial infection that primarily involves the blood stream. Blood stream infections are among the most important infections causing morbidity and mortality.[1] It may require prompt and aggressive antibiotic therapy.[2] A wide range of micro – organisms causing blood stream infections have been described. The most commonly found micro-organisms are gram – positive cocci including staphylococci, streptococci; enterococci and the gram – negative bacilli, include Pseudomonas aeruginosa, E coli and Klebsiella spp. Candida species and other yeasts also grow in blood culture.[3]

The types and frequency of these isolates may vary in different areas, age groups and clinical settings.[4-8] Morbidity and mortalities among patients infected with Gram-negative bacilli are relatively higher than among those patients who have Gram – positive cocci causing bacteraemia.[9-13] The mortality rates have been reported between 20% and 50%.[14]

Blood culture is the single most important procedure to detect blood stream and systemic infections due to bacteria.[3]

Objective

We conducted this study to identify and determine the pattern and trend of isolates from blood cultures in the department of Pathology King Edward Medical University / Mayo Hospital, Lahore.

Material and Methods

This study was based on the blood culture samples received in the department of pathology, King Edward Medical University / Mayo Hospital (a multidisciplinary teaching hospital) over a period of three years from April 2006 to March 2009. Blood samples from clinically suspected cases of septicemia / bacteraemia were collected as instructed, using proper aseptic precautions by authorized medical / paramedical personnel. Five ml. of blood from adult patients inoculated immediately into 50 ml of tryptone soya broth (TSB) with sodium polyanethol sulphonate (SPS) as anticoagulant (commercially available preparation by the name "BIOMED AEROBIC CULTURE BOTTLE", BIOMED a local commercial firm). In pediatric cases 1 – 2 ml of blood was inoculated in 10 ml of TSB with SPS. After overnight incubation the broths were subcultured on 5% sheep blood agar and MacConkey agar. Positive growth was identified by Gram staining, colony characteristics and standard tests.[15] A negative result was followed-up by examining the broth daily and doing a final subculture at the end of seventh day.[3,15] Repeat isolates from the same patient were excluded if isolation was within 14 days of a previous positive blood culture with the same isolate(s).

The data of these blood culture samples was analyzed.

Results

During this study period a total of 14548 different types of samples for culture were received. There were 1489 aerobic blood culture bottles comprising 10.24% of total culture samples.

Table 1: *Frequency table of Referring departments.*

Sr. No.	Referring Department	Frequency	Percent
1.	Medical and Allied	136	49.6
2.	Out Patient Departments	48	17.5
3.	Surgical and Allied	31	11.3
4.	Dermatology	21	7.7
5.	Intensive care units	14	5.1
6.	Neonatology	11	4.0
7.	Convalescent Home	7	2.6
8.	General Paediatrics	6	2.2
	Total	**274**	**100%**

Of the 1489 blood culture samples, microorganisms were grown in 274 giving a positive isolation rate of 18.4%.

Table 2: *Frequency table of Blood Culture Isolates and its Types.*

Sr. No.	Organisms	No. (n=) of Isolates	Percentage
1.	Staphylococcus aureus	158	56.43%
2.	Pseudomonas aeruginosa	37	13.21%
3.	Acinetobacter spp.	33	11.79%
4.	Escherichia coli	27	09.64%
5.	Klebsiella spp.	09	03.21%
6.	Enterobacter spp.	04	01.43%
7.	Streptococcus beta-hemolyticus	04	01.43%
8.	Enterococcus spp.	02	00.71%
9.	Proteus spp.	02	00.71%
10.	Staphylococcus epidermidis	02	00.71%
11.	Streptococcus pneumoniae	01	00.36%
12.	Candida spp.	01	00.36%
	Total	**280**	**100%**

Majority of the blood culture isolates were from patients of medical and allied departments (49.6%). Table 1 represents the number and percentage of samples from various clinical disciplines.

There were 151 (55.1%) male and 123 (44.9%) female patients, with male to female ratio of 1 : 0.8.

The age ranged between 0.02 to 80 years with mean of 44.45 years.

In 268 (97.8%) blood culture samples single microorganism was isolated, whereas, 6 (2.2%) yielded two microorganisms from the same sample.

The total number of isolates was 280, all bacteria but one fungus (Candida spp.).

Among 279 aerobic bacterial blood culture isolates 59.85% were Gram-positive cocci and 40.15% were Gram – negative bacilli.

The most common microorganism isolated from blood culture samples of various clinical disciplines was Staphylococcus aureus (56.43%) followed by Pseudomonas aeruginosa (13.21%), Acinetobacter spp (11.79%) and Eschericia coli (9.64%).Table 2 shows the frequency and types of varoius blood culture isolates.

Discussion

In our study a positive blood culture isolation rate was 18.4%. It has been reported variously in different studies like 11.6%,[5] 27%,[7] 27.6%[16] Butt, 20.5%[17] and 42%.[6] This variation probably reflects different populations, clinical settings, age groups, selection of the patients and other undetermined factors.

Majority (49.6%) of positive blood cultures in our study were from patients of medical and allied departments followed by outpatient (17.8%) and Surgical and allied departments (11.3%). Similarly, in two recent studies conducted in multidisciplinary teaching hospitals, Karunakaran et al reported 40.3% positive blood cultures from patients of medical and allied disciplines and Garg A et al reported 25.2% from OPD patients.

Interestingly, in our study 7.7% positive blood cultures were from dermatology department. In other studies this discipline has not been mentioned separately. It is possible that it might had been included in the Medical and allied group or in others/ miscellaneous group.

In most (97.8%) blood culture samples single micro – organism was isolated and 2.2% samples yielded two microorganisms. The polymicrobial blood stream infections have been reported by various workers with an incidence ranging from 4.5% – 18.7%, most of which were hospital acquired.[6,12,17,18]

In our study, Gram – positive bacterial isolates were more (59.85%) than Gram –

Table 3: *The distribution of blood culture isolates according to clinical disciplines.*

Sr. No.	Blood culture isolates	Referring Departments								Total
		M	O	S	D	I	N	C	P	
1.	Staphylococcus aureus	83	27	15	12	5	6	6	4	158
2.	Pseudomonas aeruginosa	15	5	4	4	4	3		2	37
3.	Acinetobacter spp.	19	8	2		3	1			33
4.	Escherichia coli	12	4	5	3	1	1	1		27
5.	Klebsiella spp.	2	2	3	1	1				9
6.	Enterobacter spp.	2	1	1						4
7.	Streptococcus beta-hemolyticus	1	3							4
8.	Enterococcus spp.			1	1					2
9.	Proteus spp.	2								2
10.	Staphylococcus epidermidis	1			1					2
11.	Streptococcus pneumoniae	1								1
12.	Candida spp.	1								1
	Total	139	50	31	22	14	11	7	6	280

Abbreviations: M = Medical and allied, O = Outpatient departments, S = Surgical and allied, D = Dermatology I = Intensive care units, N = Neonatology, C = Convalescent home, P = General paediatric.

negative (40.15%). This finding is in keeping with studies by.[4,5,19] In contrast Garg A et al, in their study from a university hospital reported 67.5% isolates were gram-negative bacilli. Mehta M et al, and Ehlag KM 1985 have also shown higher percentage of gram – negative bacilli isolated in their studies.

The most common microorganism isolated from blood culture samples from various clinical disciplines was Staphylococcus aureus (56.43%). Mahmood A found staphylococcus aureus in 39.5% cases from Medical ICU and Mahmood A et al observed it to be 16.5%. Falgas et al reported in 18.2% of their cases, and Garg A et al reported staphylococcus areus was isolated in 8,2% of their series.

In general pediatric and neonatology group of our study again staphylococcus aureus was isolated in 50% of cases which has also been predominantly isolated in several studies.[26-28] While other studies results observed Coliform bacteria in 55%,[7] Klebsiella in 33.8%[6] and E. Coli in 31.67%.[16]

In some of the larger studies from multidisciplinary hospitals[4,5,19] coagulase negative staphylococcus (S. epidermidis) was the most common blood culture isolate. which was only 0.7% in our study. The great majority of Coagulase negative staphylococcus isolates are considered contaminants by Bansal S etal,[21] Faver B etal,[22] Souvenir D et al[23] and Weinstein MP et al.[24] Even in neonates Coagulase negative staphylococcus was isolated in 24.8% of cases.[16]

The other relatively common microorganisms isolated from blood culture samples, were Pseudomonas aeruginosa (13.21%), Acinetobacter spp (11.79%) and Eschericia coli (9.64%). These have also been observed in many of the studies[4-8,25,28] with some variations in their incidence.

There was only one case of fungemia caused by candida spp. in our study, which is the common fungal isolates in some of other studies.[4,6]

Conclusion

Our study concluded that the Staphylococcus aureus was the most common blood culture isolate followed by pseudomonas aeruginosa in suscpected cases of septicemia/ bacteremia from all the various clinical disciplines.

Recommendation

Further comprehensive periodic studies are required to recognize the trends and range of blood culture isolates encountered in particular settings in a multidisciplinary teaching hospital.

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